

How firms manage their cash flows: an examination of diversification's effect

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Abstract We extend recently documented evidence that diversified firms hold significantly less cash than specialized firms to consider differences in how diversified and specialized firms adjust their cash flows to achieve their target cash balance. We find that diversified firms have higher free cash flows as a result of equal operating cash flows and lower investment in comparison to specialized firms. Diversified firms save less cash by placing less reliance on external financing; by issuing less debt and equity, and distributing higher cash dividends. Our findings support the hypothesis that diversified firms are able to hold less precautionary cash as they are in better position to finance investment opportunities internally from operating cash flows.

Keywords diversification; liquidity; free cash flow; financing cash flow; financial management.

JEL Classification D92; G32.

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We thank Anna Danielova, Andrew Marshall, Isaac Tabner, seminar participants at the University of Stirling, as well as participants at the 4th IFADS meeting, and the 2015 Financial Management Association annual meeting for their helpful comments and suggestions on earlier versions of this paper. All errors are our own.

1 Introduction

Recent studies show that corporate diversification is a key determinant of a firm's precautionary cash balance. Diversified firms who operate in more than one industrial segment hold approximately 50% less cash than specialized firms operating in a single industry (see Duchin 2010; Subramaniam et al. 2011). These studies conclude that diversified firms maintain lower precautionary cash balance because imperfect correlation of investment opportunities and cash flows across diversified firms' divisions facilitates the coordination of internal financing and investment.

While these studies provide answers to the question of why diversified firms hold less cash, they are silent on the important issue of how this lower precautionary cash balance arises. The focus of this paper is to bridge this gap by investigating the components that drive annual changes in cash balance. We define the annual change in a firm's cash balance as net cash flow, which is comprised as the sum of net cash flows from operations, investment and financing. Examining the individual components of cash flow allow us to better differentiate between agency costs of overinvestment and precautionary savings motives for accumulation of cash holdings over time.

We propose two explanations for the lower cash balance and retention of cash flows in diversified firms. Our first hypothesis is that lower net cash flow in diversified firms is the outcome of lower free cash flow (FCF), defined as operating cash flow minus investing cash flow, in comparison to specialized firms. Under this overinvestment hypothesis, diversified firms retain lower cash balances than specialized firms because they invest more of their operating cash flow. If operating cash flow is insufficient to cover investment then diversified firms can also raise external financing more easily than specialized firms (Lewellen 1971; Stulz 1990).¹

¹ Lewellen (1971) argues that imperfect correlations between divisions' cash flows may increase debt capacity by reducing default risk. Stulz (1990) provides a theoretical model in which lower cash flow volatility due to diversifications may reduce information asymmetry between managers and shareholders and consequently moderate frictions in issuing equity.

Our alternative hypothesis is that lower net cash flow in diversified firms is the outcome of larger or equal FCF relative to specialized firms. Under this precautionary savings hypothesis, operating cash flow in diversified firms is sufficiently large to cover investment demand without the need to raise external financing, which allows diversified firms to accumulate lower precautionary cash balances.

Using a sample of US firms from 1990 to 2009, we confirm that the cash balance of diversified firms is half that of specialized firms. In addition, we show that mean and median annual net cash flow in diversified firms is also half of that seen in specialized firms, indicating that diversified firms hold less cash because they accumulate cash at a slower rate than specialized firms.

Examining the components of net cash flow, we find that diversified and specialized firms generate comparable levels of operating cash flow. However, diversified firms invest less and use less external financing relative to specialized firms. Our research findings highlight that diversified firms can, on average, fully cover their investment spending from internally generated operating cash flows. As a result, FCF is insignificantly different from zero for diversified firms. By contrast, we find that specialized firms cannot support their investment activities from operating cash flow and must rely on external financing to cover the deficit. The mean (median) ratio of financing cash flow to total assets in specialized firms is 6% (0.3%) compared to 0.8% (-1.2%) in diversified firms. This finding highlights an important paradox in the results of Duchin (2010); specialized firms accumulate cash balances at a significantly faster rate than diversified firms, despite an internal financing deficit at the average specialized firm.

To examine financing cash flow in more detail we separate its components between net debt financing, equity issuance, and cash payouts to equity investors. We find that diversified firms accumulate lower cash reserves by issuing less net debt and equity, and paying more cash to equity investors through dividends, relative to specialized firms. The difference of net debt (equity) issued is equivalent to 0.5% (0.47%) total assets. Diversified firms pay higher cash

dividends, but there is no net difference in total payout between specialized and diversified firms. These results are robust to controls for endogeneity, additional control variables, and controls for unobservable heterogeneity through industry and time fixed effects.

Our research findings extend the literature on cash and liquidity management in several ways. First, we examine how diversified firms maintain lower levels of cash through management of annual cash flows. Recent studies show that diversified firms hold less cash because diversification facilitates better coordination of internally generated cash flows and investment opportunities (see Duchin 2010; Subramaniam et al. 2011). Directly examining how firms spend and save cash flows enhances our understanding of competing overinvestment and precautionary savings explanations of why diversified firms accumulate lower cash balances. We show that lower investment expenditure relative to internally generated operating cash flow is a key factor that contributes to reducing demand for precautionary cash in diversified firms (Keynes 1936; Bates et al. 2009; Kim et al. 1998; Opler et al. 1999; Anagnostopoulou 2013).

Second, our findings reveal an important insight for specialized firms. Specialized firms have negative FCF, on average, because they invest more than they earn from operations. Despite this, we show that specialized firms accumulate cash at twice the rate observed for diversified firms because they are able to raise cash through the external financing channel. These findings support the precautionary motive for holding cash – these firms accumulate and retain financing cash flows to fund future investment opportunities and to protect against unexpected future shocks to operating cash flow.

Third, the research shows how diversified (specialized) firms actively use external capital markets to adjust their cash balance over time given their higher (lower) internally generated annual free cash flows. Specialized firms actively raise debt and equity capital to finance investment requirements and to accumulate cash over time. Diversified firms do not require external debt and equity to finance investment spending, and make higher dividend payouts to equity investors to manage annual net cash flows downwards and accumulate cash at a slower

rate than observed for specialized firms. This distinction is important given the role of transaction costs, information asymmetry and agency considerations when raising capital in external markets.

The remainder of this paper is organized as follows. Section 2 introduces related literature and develops testable hypotheses. Section 3 describes the data. Section 4 presents our empirical results. Section 5 provides a summary of robustness tests. Section 6 concludes.

2 Related literature and hypothesis development

Our research is motivated by the findings that diversified firms hold less cash and accumulate cash at a slower rate over time than specialized firms (see Duchin 2010; Subramaniam et al. 2011). We extend this earlier research to show how diversified companies maintain their lower cash balance and accumulation over time. We investigate this by considering the underlying difference in net cash flow and the inputs to net cash flow; defined as operating, investing and financing cash flows, between specialized and diversified firms.

*Operating cash flow*_{*i,t*}, *Investing cash flow*_{*i,t*}, and *Financing cash flow*_{*i,t*} are net cash generated from or used in operating, investing and financing activities in year *t* respectively. The sum of these cash flows is defined as *Net cash flow*_{*i,t*}, where net cash flow is the annual change in cash balance. The difference between operating cash flow and investing cash flow is termed *Free cash flow*_{*i,t*}. Our research predictions are developed from a basic accounting relation of net cash flow and its components.

$$Net\ cash\ flow_{i,t} = (Operating\ cash\ flow_{i,t} - Investing\ cash\ flow_{i,t}) + Financing\ cash\ flow_{i,t} \quad (1)$$

$$Net\ cash\ flow_{i,t} = Free\ cash\ flow_{i,t} + Financing\ cash\ flow_{i,t} \quad (2)$$

Focusing on the cash flow statement allows for a straightforward view of how cash flow is broken down across sources and uses of cash at the firm level. Given the finding of Duchin

(2010) that diversified firms hold less cash and accumulate cash at a slower rate over time, we expect that diversified firms have lower net cash flow than specialized firms. We propose two competing hypotheses to explain the lower net cash flow of diversified firms.

First, the lower cash balance in diversified firms can be the outcome of lower free cash flow relative to specialized firms. Under this hypothesis, lower free cash flow can arise because diversified firms generate lower operating cash flows relative to specialized firms or because they invest more (Denis and Sibilkov 2010). The literature provides neither strong theoretical arguments nor clear empirical evidence that diversified firms generate less operating cash flow than specialized firms (Melicher and Rush 1973; Weston and Mansinghka 1971). Hund et al. (2010) find that diversified firms actually have higher profitability than specialized firms.

Alternatively, the ability to pool cash flows from different operating divisions allows diversified firms to self-finance investment projects without the need to raise finance in external capital markets. The ability to raise cash in internal capital markets can lead to overinvestment problems in diversified firms given the lack of external market monitoring (Jensen 1986; Inderst and Muller 2003; Ruland and Zhou 2005). As such, we expect that any difference in free cash flow between diversified and specialized firms under our first hypotheses is driven by higher investment spending in diversified firms.

In the event that annual free cash flow is negative, diversified firms can use their easier access to external capital markets to finance a sustained period of negative cash flow. Diversified firms are expected to have greater access to external capital markets than specialized firms (Shleifer and Vishny 1992). Stulz (1990) develops a theoretical model in which lower cash flow uncertainty due to diversification reduces the cost of underinvestment. This can arise because shareholders will be more credibly convinced to provide new capital when a firm's expected and realized cash flows are less likely to be significantly different.² Lewellen (1971) argues that the

² Hadlock et al. (2001) empirically support the argument by showing that equity issues by diversified firms are viewed less negatively than those of specialized firms.

imperfect correlations between divisions' cash flows may increase debt capacity of firms by reducing the probability of default.³

This leads us to posit:

Hypothesis 1a. Free cash flow in diversified firms is less than free cash flow in specialized firms.

Hypothesis 1b. Financing cash flow in diversified firms is greater than financing cash flow in specialized firms.

We refer to this first hypothesis as the overinvestment hypothesis.

Alternatively, the lower cash balance in diversified firms can be the outcome of free cash flow that is greater than or equal to free cash flow in specialized firms. When operating cash flow is sufficient and stable to cover investment, the precautionary saving theory introduced in Keynes (1936) and Kim et al. (1998) suggests that firms do not need to save cash as they can finance investments from low-cost operating cash flow. This can arise whereby ongoing operating cash flows in diversified firms are greater than or equal to operating cash flow in specialized firms and/or because investing cash flows in diversified firms are less than or equal to investing cash flows in specialized firms.

If free cash flow at diversified firms is greater than or equal to free cash flow at specialized firms it must also hold that diversified firms have lower financing cash flow relative to specialized firms.⁴ Rather than retain cash, diversified firms achieve the lower cash balances documented in Duchin (2010) by using free cash flow to pay back debt or distribute to shareholders through stock repurchases and dividends. This results in diversified firms having

³ Dimitrov and Tice (2006) and Peyer (2002) provide empirical evidence supporting this argument.

⁴ Denis and Sibilikov (2010) set out an extreme scenario in which firms with low cash flow and limited access to external finance are forced to have less cash as they are unable to accumulate cash reserves and/or are forced to drain previously accumulated cash reserves. However this is less likely the case for diversified firms, who we expect to have greater access to external capital markets given their lower risk and larger asset base.

lower financing cash flow than specialized firms.⁵ This is consistent with Duchin (2010) whereby the imperfect correlation of cash flows and investment opportunities within diversified firms facilitates the use of operating cash flow to self-finance investments and allows diversified firms to retain lower precautionary cash balances. This reduces the precautionary demand for cash holdings within diversified firms.

We posit:

Hypothesis 2a. Free cash flow in diversified firms is not less than free cash flow in specialized firms.

Hypothesis 2b. Financing cash flow in diversified firms is less than financing cash flow in specialized firms.

We refer this second hypothesis as the precautionary saving hypothesis.

We examine these competing hypotheses by investigating differences in the components of annual net cash flows between diversified and specialized firms.

3 Sample data

The sample includes all US firms available from Worldscope covering the 20-year period from 1990 to 2009. All sample data is CPI-adjusted to year 2000 dollars. Firm and segment level data on assets, capital expenditure, depreciation, operating income, and SIC codes are extracted from Worldscope. Thompson Financial is used to retrieve cash flow data.

Following Berger and Ofek (1995), we exclude financial and utility firms but do not exclude firms with financial segments. Furthermore, all firm-year observations with missing segment SIC codes or market capitalization of less than \$10 million are removed from the

⁵ Under the pecking order model of Myers (1984), given the higher cost of external financing relative to internal financial resources, firms will choose to fund all projects using available internal finance before accessing to progressing to external financing sources. Empirical evidence of the negative relation between internal and external financing is provided in Shyam-Sunder and Myers (1999) and Acharya et al. (2007).

sample. We also require that sample firms do not have cash holdings, any cash flow components, or total long-term debts larger than the value of total assets. To ensure the integrity of segment data, only firm-year observations with sum of segment sales within 1% of firm's total sales are kept in the sample. The final sample includes 34,869 firm-year observations for 4,560 firms.

Following prior literature, we define a specialized firm as one that operates in a single 2-digit SIC industrial segment. Diversified firms are those who operate in more than one 2-digit SIC industrial segment. We report all additional variable definitions in Table 1.

INSERT TABLE 1 HERE

Table 2 presents summary statistics for the core variables used in this study. 29.6% of firm-years are diversified and the median firm reports two industrial segments. The mean (median) cash balance of 19.2% (9.6%) corresponds closely with the descriptive statistics of Bates et al. (2009) over a similar time period.

INSERT TABLE 2 HERE

The positive value for average net cash flow indicates that sample firms have accumulated cash holdings over the sample period. However, this has been achieved through external financing rather than retentions from internally generated FCF. The average firm finances investments equivalent to 8.7% of assets each year, which is financed through operating cash flow equivalent to 5.9% of assets and financing cash flow equivalent to 4.4% of assets. The residual is retained as net cash flow, which is equivalent to 1.6% of total assets per annum.

Our subsequent regression analysis examines the determinants of the components of firm cash flows. We base our regression models on Opler et al. (1999), Bates et al. (2009) and Duchin (2010) who examine the determinants of a firm's cash holdings. We omit control

variables from the regression models examined in these studies that are captured by our dependant cash flow variables, including dividend payments and capital expenditures. We control for firm size to proxy for a firm's access to external capital markets (Opler et al. 1999). Firm size is also positively correlated with firm age, which we expect is related to investment opportunities and demand for external capital. Tobin's Q is used to proxy for investment opportunities and is defined following Duchin (2010). Leverage is also expected to be correlated with the cost and ability to raise external finance (Almeida and Campello 2010; Iskandar-Datta and Jia 2014). Return on Assets (ROA) is used to control for profitability, which we expect to be correlated with operating cash flow and the demand for external financing. When examining the determinants of net investing and financing cash flow, we additionally control for lagged net working capital and cash holdings and contemporaneous operating cash flow, which indicate the pre-existing stock of internal funding (Hill et al. 2014). Year and 2-digit SIC industry dummies are included in all regression models to absorb industry and time-specific effects that are expected to be correlated with a firm's investment opportunities and availability of external financing (Opler et al. 1999).

One concern in our regression analysis is correlation amongst explanatory variables. Table 3 presents pairwise correlations of our dependent and explanatory variables. As expected, several cash flow components are mechanically correlated given their definition. For example, free cash flow is positively and negatively correlated with operating and investing cash flow respectively. Correlations amongst the explanatory variables are all below 0.5. We also estimate variance inflation factors (VIFs) for our explanatory variables and find that no individual VIF is above 2. Collectively, these findings suggest that multicollinearity does not affect our subsequent regressions analysis.

INSERT TABLE 3 HERE

4 Differences in cash flows between specialized and diversified firms

4.1 Univariate analysis of differences in cash flow across diversified and specialized firms

Looking at cash flow components in diversified and specialized firms provides an initial overview of differences in these firms' financial management policy and how these firms have adjusted their cash flows to maintain their observed cash position. Accordingly, Table 4 reports firms' cash flow components for the sub-sample of 10,309 diversified firm-year observations relative to the sub-sample of 24,560 specialized firm-year observations. We compare mean and median differences in cash and cash flows across each group of firm year observations.

INSERT TABLE 4 HERE

We confirm the finding of lower cash holdings in diversified firms relative to specialized firms (see Duchin 2010; Subramaniam et al. 2011). The mean (median) of ratio of cash holdings to total assets for specialized firms is approximately double the corresponding figure for diversified firms.⁶ Importantly, the annual speed of accumulating cash in specialized firms is also twice that of diversified firms. The mean (median) ratio of net cash flow to total assets in specialized firms is 1.9% (0.4%) compared to 0.8% (0.2%) in diversified firms.⁷

To study how the components of firm level cash flows vary between specialized and diversified firms we separate cash flows between operating, financing and investing cash flows. Consistent with Hund et al. (2010), we find higher operating cash flows of 8% for diversified firms relative to 5.1% for specialized firms. These preliminary results are consistent with hypothesis 2a that FCF in diversified firms is greater than or equal to FCF in specialized firms and support the precautionary saving hypothesis.

⁶ In an unreported analysis, we confirm the finding of a negative relation between cash holdings and corporate diversification in a regression analysis after controlling for a series of variables outlined in Opler et al. (1999).

⁷ Our unreported analysis shows that average ratio of net cash flows to total assets in specialized firms is larger than diversified firms in 17 out of 20 years during the period 1990-2009. Additionally, during this 20 year period, net cash flow is positive in 18 years for specialized firms and 17 years for diversified firms.

Our univariate results also highlight that specialized firms accumulate cash at a quicker rate, despite lower free cash flows, through greater use of financing cash flow. The mean (median) ratio of financing cash flow to total assets in specialized firms is 6% (0.3%) compared to 0.8% (-1.2%) in diversified firms. Specifically, diversified firms' lower financing cash flows are the result of issuing significantly less equity and distributing higher cash payouts. On average, annual gross equity issuance is 8.1% of total assets in specialized firms while it is just 3.1% total assets in diversified firms. Moreover, average net equity issuance and dividend payouts in diversified firms are equal to 1.2% of total assets. Specialized firms, in contrast, rely heavily on external equity to finance their investment spending. Net equity issuance in specialized firms is, on average, equal to 6.1% total assets while dividend payouts equal 0.9% of their assets. These univariate statistics are consistent with hypothesis 2b that financing cash flow in diversified firms is less than financing cash flow in specialized firms.

Overall, the results from our univariate analysis suggest that (i) during the period 1990-2009, both diversified and specialized firms have been increasing their cash balances; and (ii) the rate of cash building in specialized firms is more than double that in diversified firms. Diversified and specialized firms actively adopt distinct financial policies to manage their cash balance. Despite their FCF deficit, specialized firms raise external debt and equity financing to both finance investment spending and to accumulate cash on the balance sheet at a faster rate than observed for diversified firms.

4.2 Multivariate analysis of differences in cash flow across diversified and specialized firms

We extend our analysis to estimate regressions of the determinants of cash flows and relate these to firm diversification and other control variables known to be correlated with firm level cash flows (see Almeida and Campello 2010; Denis and Sibilkov 2010; Gatchev et al. 2010). Standard errors are clustered at the firm level and we control for unobservable heterogeneity through industry and time fixed effects. These results are presented in Table 5.

INSERT TABLE 5 HERE

We find no significant difference in operating cash flows between diversified and specialized firms in Model 1 while Models 2 and 3 show that both investment and financing cash flow in diversified firms is significantly lower than the corresponding figures for specialized firms. This confirms that specialized firms do not accumulate cash more quickly than diversified firms because they generate higher level of operating cash flows nor because they invest less. Combining operating and investing cash flow, model 4 shows that FCF in diversified firms is significantly higher than FCF in specialized firms. These findings support hypotheses 2a (higher FCF) and 2b (lower financing cash flow) for differences in cash flow between diversified and specialized firms the precautionary saving hypothesis for lower cash holdings and accumulation in diversified firms.

These differences are also economically significant. The mean difference of free cash flow (financing cash flow) between diversified and specialized firms is equivalent to 1.08% (1.12%) of firms' total assets. The difference in investing cash flow between these firms is also non-trivial in economic terms and is equivalent to 0.78% value of total assets.

For our control variables we find that Tobin's Q is positively correlated with investment spending and therefore negatively related to FCF. Q is also positively related to financing cash flow, suggesting that firms with valuable investment opportunities are more likely to raise external financing. Financing cash flow is negatively related to firm size, suggesting that larger firms are more likely to finance investments from internally generated cash flows. Firm size is also positively related to operating cash flow. We find general support for the pecking order model of project financing given the negative relation between financing cash flow and both lagged cash balance and operating cash flow, and the positive relation between leverage and both investing and financing cash flow.

Taken together, our findings show that diversified firms have higher FCF than specialized firms as they generate the same level of operating cash flow but invest less. Despite lower FCF, specialized firms accumulate cash at a quicker rate than diversified firms through higher net financing cash flows. Our findings complement Duchin (2010) who shows that greater coordination of cash flows and investment opportunities contributes to lower precautionary cash holdings in diversified firms. We find that lower investment expenditure, both in absolute terms and relative to operating cash flow is also a factor that according to precautionary motivation of saving cash contributes to reduced demand for cash in diversified firms (Bates et al. 2009; Kim et al. 1998; Opler et al. 1999).

4.3 Differences in financing cash flow between specialized and diversified firms

Our work in the previous section highlights that actively raising external financing allows specialized firms to accumulate cash more quickly than diversified firms despite negative internally generated FCF. Our findings also fail to support an agency cost of free cash flow hypothesis that diversified firms retain less cash due to overinvestment in value destroying projects.

This section extends our previous analysis to examine the individual components of financing cash flow identified by Dittmar and Duchin (2010) and Gatchev et al. (2010) as channels for firms to adjust their cash ratio, in a multivariate format. Separating financing cash flow between debt and equity raised and cash paid out through dividends and repurchases also allows us to distinguish between competing explanations of diversified firms' lower financing cash flow. We propose that diversified firms choose to raise less external financing cash flow. However, as a counter argument, it is also possible that diversified firms are less able to raise finance externally. If diversified firms do have more difficulty in accessing external capital markets to raise cash they would likely compensate by paying lower dividends than specialized firms. Therefore, observing a higher level of cash payouts to equity investors would reject the

limited external finance explanation and suggest that diversified firms actively choose to maintain lower financing cash flow. Table 6 presents the results obtained from the estimation of these models.

INSERT TABLE 6 HERE

Our empirical results favor the proposition that diversified firms choose to issue less debt and equity, but at the same time pay higher dividends to investors. We find that diversified raise less cash through debt issuance, and both gross and net equity issuance, whilst paying higher dividends to equity investors. The differences are again significant in both statistical and economic terms. The difference of net debt issuance is equivalent to 0.5% of total assets while it is equal to 0.47% of total assets for net equity issuance. Our results suggest that specialized firms use both debt and equity financing to finance the free cash flow shortfall identified previously and to accumulate cash on the balance sheet. Debt and equity are of similar economic importance relative to book value of assets.

The difference in dividend payouts between diversified and specialized firms is less pronounced, but remains statistically significant and is equivalent to 0.14% of total assets. This is consistent with studies of payout policy that find dividends are paid by firms with more predictable cash flows (e.g. Guay and Harford 2000). The imperfect correlation of cash flows across the segments of diversified firms allows for greater stability in dividend payouts. Diversified firms spend less on the repurchase of their own shares than specialized firms although the difference is insignificant.⁸ Total cash payouts are also statistically indifferent between both types of firm, highlighting that dividend payments from steady operating cash flow at diversified firms drive any differences in payout policy between the two groups of firms.

⁸ The finding that specialized firms repurchase more shares than diversified firms is consistent with arguments made in several studies on payout policy (see Jagannathan et al. 2000). Stock repurchases are viewed as a more suitable way to distribute profits in firms with less stable earning streams.

Among control variables, firm size is positively related to access to both debt and equity financing, and with payout policy through both dividends and repurchases. Cash holdings are positively related to cash payouts and dividends are increasing with ROA. Consistent with the pecking order theory, operating cash flow is positively related to total payouts but is negatively related to the demand for debt and equity financing.

Summarily, our research suggests that diversified firms choose to maintain a lower cash balance by issuing less debt and equity capital and by distributing more cash as dividends relative to specialized firms. This extends the findings of Duchin (2010) by highlighting the channels through which diversified firms adapt their financial policy to maintain their lower cash balance.

5 Robustness tests

This section presents a summary of additional analysis and robustness testing that we have carried out to ensure the validity of our core findings.

5.1 Change of cash flow characteristics around diversification decision

A concern with our core analysis in Table 5 is simultaneity or reverse causality between past accumulation of cash holdings and the ability to become diversified through greater investment spending. Anderson et al. (2011) find that firm risk changes surrounding diversifying acquisitions and we expect this will also have implications for the precautionary demand for cash holdings.

To address this concern we identify a sub-sample of firms that choose to become diversified, which we define as companies moving from a single industrial segment to more than one industrial segment in a given year (year t). For these cases, we examine mean and median changes in the components of net cash flow from one year prior ($t-1$) to one year following ($t+1$) the decision to become diversified. We exclude the diversification year to avoid any mechanical effects of the decision to become diversified, such as an increase in investment expenditure to acquire diversifying business assets. Table 7 presents the results of this analysis.

INSERT TABLE 7 HERE

Consistent with the precautionary theory of cash holdings, diversifying firms reduce cash holdings in the year following the decision to diversify. For firms that become diversified, we find no change in operating cash flow and a reduction in investment spending, and as a result an increase in FCF, which supports hypothesis 2a. Firms also place less reliance on external finance in the year following the decision to become diversified, which supports our hypothesis 2b. Both findings are consistent with the precautionary motive for cash holdings. The differences in our key cash flow components are significant at the 5% level or better in all cases.

5.2 Alternative definitions of cash flow and diversification variables

We also examine the robustness of our results in Table 5 to the definition of cash flow and diversification variables. Table 8 reports the analyses with various alternative specifications using Table 5 as the base. Panel A keeps the dependent variables from Table 5 and uses the number of segments to proxy for corporate diversification as in Lang and Stulz (1994). Panel B uses alternative dependent variables the diversification dummy used in our earlier testing. In Panel B we replace operating cash flow with net income plus depreciation, investing cash flow with capital expenditures, and thus free cash flow as the difference between the two. Financing cash flow is replaced by the total of net equity and debt issuance, following Almeida and Campello (2010). In Panel C these new dependent variables are regressed on the number of segments. For brevity, we omit the coefficients for control variables and present only results for the proxy of firm diversification.

INSERT TABLE 8 HERE

Results from the table are largely consistent with our findings in Table 5. In Panel A, when number of segments is used to represent firm diversifications, the coefficients of the variables are similar in terms of significance level and magnitude to those reported earlier, suggesting that diversified firms have higher FCF than specialized firms, and lower investing and financing cash flow. In Panels B and C where alternative measures of cash flow components and different proxies for firm diversification are utilized, all results remain consistent with Table 5.

These findings confirm our earlier result that diversified firms have higher level of free cash flow as they have similar level of operating cash flow and lower level of investing cash flow in relative to specialized firms.

5.3 Effect of firm size and R&D expenditure

Duchin's (2010) analysis emphasizes the important role for the functioning of internal capital markets in the relation between diversification and cash holdings. We expect that the functioning of these internal markets is also correlated with both firm size and research and development (R&D) expenditure and we examine this issue in Tables 9 and 10 respectively.

Table 9 replicates the core findings from Table 5 separately for large (Panel A) and small firms (Panel B). Large firms are defined as firm-years in the upper quartile of book value of total assets and small firms are those in the lowest three quartiles of book value of assets.⁹ Our findings on the core relation between corporate diversification and the components of net cash flow are consistent across both panels. We again find a negative relation between diversification and both investing and financing cash flow, and a positive relation between diversification and free cash flow. This confirms that our earlier support for hypotheses 2a and 2b is not a result of spurious correlation arising from the impact of firm size on diversification and the functioning of internal capital markets.

⁹ Our results are unchanged if we define large firms as those with book value of assets above the sample median.

INSERT TABLES 9 AND 10 HERE

Pinkowitz et al. (2015) argue that R&D intensive firms have incentives to hold more cash to hedge against future underinvestment risks. Lyandres and Palazzo (2015) show that increases in cash holdings in recent years are driven almost exclusively by innovative and R&D intensive firms. We examine this issue in more depth here. Table 10 replicates our findings separately for firms with positive R&D values and those with zero R&D values. Following Opler et al. (1999) firm years with missing R&D values are treated as zero values in our analysis. Approximately 27% of firm years have positive values for R&D data and we present results for these findings in Panel A. Panel B reports our findings for firms with zero R&D expenditure.

Focusing on R&D firms in Panel A, we again find that diversified firms invest less and make less use the financing cash flow channel than specialized firms. Operating cash flows in diversified firms are lower than for a specialized firm, which leads to no difference in free cash flow between diversified and specialized firms. However, our key finding that specialized firms invest greater amounts than diversified firms and finance this through greater use of external financing remains. Our results for non-R&D firms in Panel B are identical to those presented in Table 5. Diversified firms are characterized by lower investing cash flow, higher FCF and lower financing cash flow relative to specialized firms.

6 Conclusions

This paper examines the link between corporate diversification, corporate liquidity and financial management by investigating the differences in cash flow components between diversified and specialized firms. Duchin (2010) and Subramaniam et al. (2011) document significantly lower cash holdings and annual accumulation of cash in diversified firms. This paper asks how diversified firms manage their cash flows to maintain this lower rate of cash accumulation.

Using a sample of 34,869 US firm-year observations from 1990 to 2009, we find that diversified firms generate a similar level of operating cash flow and invest less than specialized firms. Operating cash flow in diversified firms is sufficient to fully cover investment demand, suggesting that diversified firms make a strategic choice to save less cash within the firm, rather than because they generate less cash within the firm. We show that diversified firms have lower cash balances because they make less use of external financing relative to specialized firms. More specifically, we show that diversified firms raise significantly less debt, less equity, and distribute higher cash dividends than specialized firms. Specialized firms accumulate cash at a quicker rate despite investing more than internally generated operating cash flow. They achieve this through raising debt and equity in external capital markets to cover investment spending and accumulate cash on the firm's balance sheet.

Our results confirm the important assumption underlying the work of Duchin (2010) that diversified firms have lower optimal level of cash holdings because they are in better position to internally finance investments from operating cash flow. We also show that in addition to greater coordination of cash flows and investment opportunities, lower investment expenditure in diversified firms is a factor that according to the precautionary motivation for cash holdings contributes to reduce demand for cash in these firms.

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Table 1 Variable definitions

Variable	Definition
Diversification	Dummy variable that takes a value of one for diversified firms and zero for specialized firms
Segments	A count of the number of industrial segments that represent 10% or more of firm consolidated revenues
Specialized firms	Firms with segment(s) operating in only one two-digit SIC code
Diversified firms	Firms operating in more than one two-digit SIC code
Cash/assets	Cash and short-term investments /total assets
Cash flow/assets	(Income before extraordinary items + depreciation and amortization)/total assets
Net operating cash flow/assets	Net cash receipts and disbursements from operating activity representing the sum of cash flow, extraordinary items and other operating cash flow /total assets
Net cash flow/assets	Change in cash and short-term investment from one year to the next/total assets
Other operating cash flow/assets	Net change in working capital excluding changes in short term borrowings and changes in cash /total assets
Net investing cash flow/assets	Net cash receipts and disbursements resulting from capital expenditures, disposal of fixed assets, increase in other assets and other investing activities /total assets
Capex/assets	Capital expenditure / total assets
Acquisition/assets	Assets acquired from acquisitions or mergers/total assets
Assets sale/assets	Amount received from the sale of property, plant and equipment /total assets
Free cash flow (FCF)/assets	Net operating cash flow/assets – Net investing cash flow/assets
Net financing cash flow/assets	Net cash receipts and disbursements resulting from changes in long or short term debt, proceeds from sale of stock, stock repurchased, dividends paid and other financing activities/total assets
Net debt issuance/assets	(Long-term debt issuance – long-term debt reduction)/total assets
Gross equity issuance/assets	Sale of common and preferred stocks/ total assets
Net equity issuance/assets	(Sale of common and preferred stocks - purchase of common and preferred stocks)/total assets
Repurchases/assets	Purchase of common and preferred stocks/total assets
Dividend/assets	Cash dividends for common stocks/total assets
Payout/assets	(Cash dividends + purchase of common and preferred stocks)/total assets
Firm size	Natural logarithm of book value of total assets
Tobin's Q	Market value of assets (total assets+ market value of common equity – common equity – deferred taxes)/(0.9*total assets + 0.1* market value of assets)
Leverage	(Debt in current liabilities + long-term debt)/ total assets
Net working capital (NWC)/assets	(Current assets – current liabilities – cash)/ total assets
Return on Assets (ROA)	(Net income/ total assets)*100

This table describes the definition of variables used in this paper.

Table 2 Summary statistics

Variable	Mean	Median	Standard deviation	Number of observations
Diversification	0.296	0.000	0.456	34,869
Segments	2.062	2.000	1.454	34,869
Cash/assets	0.192	0.096	0.225	34,869
Cash flow/assets	0.048	0.086	0.182	34,869
Net operating cash flow/assets	0.059	0.083	0.156	34,832
Net cash flow/assets	0.016	0.003	0.132	34,836
Net investing cash flow/assets	0.087	0.066	0.150	34,832
Free cash flow/assets	-0.028	0.006	0.192	34,829
Net financing cash flow/assets	0.044	0.000	0.197	34,830
Firm size	5.655	5.546	1.899	34,869
Tobin's Q	1.853	1.514	1.095	34,869
Capex/assets	0.063	0.042	0.076	34,850
Leverage	0.198	0.159	0.193	34,846
Repurchases/assets	0.018	0.000	0.055	34,416
Dividend/assets	0.010	0.000	0.035	34,791
Payout/assets	0.028	0.003	0.068	34,366
NWC/assets	0.097	0.085	0.196	34,674
Return On Assets (ROA)	-0.001	0.042	0.185	34,869

This table contains summary statistics for a sample of nonfinancial and nonutility US firms from 1990 to 2009 with non-missing segment data and total market capitalization greater than \$10M. Data is taken from Worldscope and Thomson Financial. Firms with any of cash flow components, cash holdings or total long-term debt greater than total assets are excluded from the sample. All variables are defined in Table 1.

Table 3 Correlation matrix

	Cash / assets	Cash flow / assets	Net cash flow / assets	Net operating cash flow / assets	Net investing cash flow / assets	Free cash flow / assets	Net financing cash flow / assets	Diversifi- cation	Firm size	Tobin's Q	Capex / assets	Leverage	Dividend / assets	Payout / assets	NWC / assets
Cash flow/assets	-0.289														
Net cash flow/assets	0.231	0.133													
Net operating cash flow/assets	-0.254	0.770	0.194												
Net investing cash flow/assets	-0.033	0.144	-0.189	0.216											
Free cash flow/assets	-0.182	0.516	0.306	0.649	-0.603										
Net financing cash flow/assets	0.332	-0.413	0.376	-0.500	0.460	-0.767									
Diversification	-0.198	0.098	-0.038	0.085	-0.034	0.096	-0.120								
Firm size	-0.325	0.300	-0.031	0.322	0.021	0.246	-0.260	0.278							
Tobin's Q	0.377	-0.096	0.165	-0.089	0.115	-0.163	0.270	-0.129	-0.237						
Capex/assets	-0.173	0.108	-0.060	0.148	0.356	-0.157	0.112	-0.028	0.017	0.025					
Leverage	-0.431	-0.027	-0.075	-0.009	0.034	-0.034	-0.017	0.136	0.271	-0.237	0.088				
Dividend/assets	-0.046	0.153	-0.041	0.168	-0.047	0.174	-0.197	0.043	0.100	0.063	-0.009	-0.014			
Payout/assets	-0.002	0.219	-0.063	0.261	-0.096	0.288	-0.323	0.027	0.146	0.117	-0.021	-0.046	0.571		
NWC/assets	-0.282	0.249	-0.042	0.088	-0.067	0.124	-0.149	0.018	-0.034	-0.213	-0.141	-0.097	0.003	-0.048	
ROA	-0.248	0.975	0.150	0.734	0.134	0.496	-0.381	0.100	0.299	-0.081	0.047	-0.044	0.149	0.214	0.285

This table presents pairwise correlations of dependent and explanatory variables for our sample of nonfinancial and nonutility US firms from 1990 to 2009 with non-missing segment data and total market capitalization greater than \$10M. Data is taken from Worldscope and Thomson Financial. Firms with any of cash flow components, cash holdings or total long-term debt greater than total assets are excluded from the sample. All variables are defined in Table 1.

Table 4 Cash flow differences between diversified and specialized firms

Variable names	Specialized firms		Diversified firms		T-statistics of difference in means	Wilcoxon P-value
	Mean	Median	Mean	Median		
Cash/assets	0.221	0.126	0.124	0.060	39.140***	<.0001***
Net cash flow/assets	0.019	0.004	0.008	0.002	7.180***	<.0001***
Net operating cash flow/assets (A)	0.051	0.079	0.080	0.088	-15.940***	<.0001***
Cash flow/assets	0.036	0.083	0.075	0.091	-18.390***	<.0001***
Other operating cash flow/assets	-0.015	-0.010	-0.013	-0.009	-2.180**	0.071*
Net investing cash flow/assets (B)	0.091	0.068	0.080	0.063	6.550***	<.0001***
Capex/assets	0.065	0.041	0.060	0.043	5.410***	<.0001***
Acquisition/assets	0.025	0.000	0.029	0.000	-5.380***	<.0001***
Asset sale/assets	0.010	0.000	0.014	0.001	-5.820***	<.0001***
Free cash flow/assets (FCF)	-0.040	0.000	0.000	0.019	-18.180***	<.0001***
Net financing cash flow/assets (C)	0.060	0.003	0.008	-0.012	22.590***	<.0001***
Net debt issuance/assets	0.007	0.000	0.009	0.000	-1.390	0.602
Gross equity issuance/assets	0.081	0.007	0.031	0.004	25.250***	<.0001***
Net equity issuance/assets	0.061	0.002	0.012	0.000	23.910***	<.0001***
Repurchases/assets	0.018	0.000	0.019	0.000	-1.040	<.0001*** ¹⁰
Dividend/assets	0.009	0.000	0.012	0.001	-8.040***	<.0001***
Payout/assets	0.027	0.000	0.031	0.001	-5.010***	<.0001***

This table reports a comparison of mean and median cash flows across diversified and specialized firms. Positive (negative) items in sections (A) and (C) with the exception of cash payouts to equity investors through dividends or repurchases represent cash inflows (outflows). Positive (negative) items in section (B) represent cash outflows (inflows) with the exception of asset sales. All variables are defined in Table 1. The Wilcoxon p-value is the probability value of a Wilcoxon test of the hypothesis that the two samples have same underlying distribution.

***, ** and *, indicate that differences are significant at the 1%, 5%, and 10% level respectively.

¹⁰ This indicates that median repurchase payout in diversified firms is statistically larger than in specialized firms.

Table 5 Diversification and cash flow components

Dependent Variable	Model 1		Model 2		Model 3		Model 4	
	Net operating cash flow/assets		Net investing cash flow/assets		Net financing cash flow/assets		Free cash flow/assets	
	Est.	t Value	Est.	t Value	Est.	Est.	Est.	t Value
Intercept	0.666	0.670	-3.719	-1.410	-3.746	-1.270	-27.950	-4.120 ***
Diversification	-0.089	-0.550	-0.779	-4.170 ***	-1.127	-5.690 ***	1.077	5.150 ***
Firm size	0.979	17.530 ***	-0.007	-0.120	-0.353	-5.440 ***	0.857	12.890 ***
Tobin's Q	0.069	0.700	1.789	14.850 ***	3.123	20.760 ***	-1.818	-12.900 ***
Leverage	-0.738	-1.510	8.016	12.330 ***	7.847	10.940 ***	-6.007	-8.590 ***
ROA x 100	0.586	62.490 ***	-0.016	-1.610	-0.001	-0.090	0.468	46.730 ***
Lagged NWC/assets			1.563	2.750 ***	1.421	2.150 **		
Lagged Cash/assets			2.870	4.540 ***	-1.550	-2.280 **		
Net operating cash flow/assets			0.265	19.760 ***	-0.545	-37.740 ***		
Year fixed effects	Yes		Yes		Yes		Yes	
Industry fixed effects	Yes		Yes		Yes		Yes	
R-Square	0.581		0.146		0.319		0.299	
N Obs	34,809		30,109		30,109		34,806	

This table reports regressions of the determinants of cash flows. These models use OLS regression with year and industry fixed effects and standard errors are clustered at the firm level. All variables are defined in Table 1.

***, ** and *, indicate that estimates are significant at the 1%, 5%, and 10% level respectively.

Table 6 Distribution of financing cash flow

Dependent Variable	Model 1			Model 2			Model 3			Model 4			Model 5			Model 6		
	Net debt issue/assets			Net equity issue/assets			Gross equity issue/assets			Repurchase/assets			Dividend/assets			Payout/assets		
	Est.	t Value		Est.	t Value		Est.	t Value		Est.	t Value		Est.	t Value		Est.	t Value	
Intercept	-5.012	-10.060	***	3.815	1.300		-0.650	-0.210		-4.394	-8.100	***	-0.252	-0.800		-4.646	-6.050	***
Diversification	-0.501	-3.890	***	-0.472	-2.960	***	-0.552	-4.350	***	-0.088	-0.890		0.140	2.360	**	0.052	0.440	
Firm size	0.388	5.980	***	2.835	19.570	***	3.480	26.080	***	0.628	8.130	***	0.310	6.440	***	0.938	9.990	***
Tobin's Q	0.319	8.080	***	-0.581	-10.760	***	-0.313	-7.560	***	0.266	7.330	***	0.095	3.540	***	0.361	7.970	***
Leverage	13.416	21.720	***	-6.268	-11.160	***	-6.060	-13.690	***	0.157	0.420		-0.548	-2.160	**	-0.390	-0.840	
ROA x 100	0.061	8.700	***	-0.074	-8.420	***	-0.069	-8.590	***	0.005	1.630		0.006	2.420	**	0.012	2.790	***
Lagged NWC/assets	3.721	8.180	***	-2.385	-3.700	***	-3.109	-5.180	***	-0.763	-2.820	***	0.381	2.280	**	-0.381	-1.160	
Lagged Cash/assets	4.056	8.600	***	-5.095	-8.250	***	-2.758	-4.900	***	2.266	8.030	***	0.315	1.990	**	2.580	7.960	***
Net operating cash flow/assets	-0.125	-14.300	***	-0.333	-26.720	***	-0.250	-23.860	***	0.082	11.600	***	0.027	6.760	***	0.109	13.640	***
Year fixed effects	Yes			Yes			Yes			Yes			Yes			Yes		
Industry fixed effects	Yes			Yes			Yes			Yes			Yes			Yes		
R-Square	0.090			0.275			0.294			0.122			0.082			0.147		
N Obs	29,162			29,162			29,162			29,162			29,162			29,162		

This table reports regressions of the determinants of individual components of financing cash flows. These models use OLS regression with year and industry fixed effects and standard errors are clustered at firm level. All variables are defined in Table 1.

***, ** and *, indicate that estimates are significant at the 1%, 5%, and 10% level respectively.

Table 7 Changes in cash flow surrounding the decision to diversify

	Net operating cash flow/assets	Net investing cash flow/assets	Net financing cash flow/assets	Free cash flow/assets
Mean difference	0.002	-0.019***	-0.040***	0.021***
Median difference	0.000	-0.004**	-0.009***	0.011***
N Obs	642	642	642	642

This table reports changes univariate analysis of changes in cash flows for companies that diversify. We define a diversifying firm as one that previously operated in a single industrial segment to one that now operates in more than one segment. Increases in the number of segment occur at year zero and changes in cash and cash flows are reported over the period t-1 to t+1. All variables are defined in Table 1.

***, ** and *, indicate that differences are significant at the 1%, 5%, and 10% level respectively for a two sample t-test of difference in means and a Wilcoxon sign rank test of the median difference.

Table 8 Robustness test for different measures of cash flows' components and firms' diversifications

	Model 1		Model 2		Model 3		Model 4	
<i>Panel A: Firm diversification measured as the number of Segments</i>								
Dependent Variable	Net operating cash flow/assets		Net investing cash flow/assets		Net financing cash flow/assets		Free cash flow/assets	
	Est.	t Value	Est.	t Value	Est.	t Value	Est.	t Value
Segments	-0.097	-1.910*	-0.205	-3.570***	-0.304	-4.870***	0.159	2.450**
<i>Panel B: Alternative definition of cash flow components</i>								
Dependent Variable	Cash flow /assets		Capex/assets		External finance /assets		Free cash flow /assets	
	Est.	t Value	Est.	t Value	Est.	t Value	Est.	t Value
Diversification	0.041	0.470	-0.456	-3.440***	-0.988	-5.160***	0.483	3.910***
<i>Panel C: Firm diversification measured as the number of Segments and alternative definition of cash flow components</i>								
Dependent Variable	Cash flow /assets		Capex/assets		External finance /assets		Free cash flow /assets	
	Est.	t Value	Est.	t Value	Est.	t Value	Est.	t Value
Segments	0.038	1.260	-0.148	-3.640***	-0.252	-3.990***	0.188	4.780***

This table reports regressions of the determinants of cash flows. The regressions presented are similar to those presented in Table 5 but change the dependent cash flow components and/or replace *Diversification* with *Segments* as the main explanatory variable. We report only the results for the main explanatory variable of the impact of firm diversification on cash flow components. All control variables and regression statistics are omitted for brevity. These models use OLS regression with year and industry fixed effects and standard errors are clustered at firm level. All variables are defined in Table 1.

***, ** and *, indicate that estimates are significant at the 1%, 5%, and 10% level respectively.

Table 9 Diversification and cash flow components for large and small firms

<i>Panel A: Firm years with book value of total assets in the upper quartile</i>								
Dependent Variable	Model 1		Model 2		Model 3		Model 4	
	Net operating cash flow/assets		Net investing cash flow/assets		Net financing cash flow/assets		Free cash flow/assets	
	Est.	t Value	Est.	t Value	Est.	Est.	Est.	t Value
Intercept	8.019	7.070***	0.329	0.160	1.702	0.880	1.625	0.740
Diversification	-0.075	-0.550	-0.765	-3.090***	-0.942	-3.820***	0.855	3.310***
Firm size	-0.108	-1.670*	-0.598	-5.380***	-0.666	-5.910***	0.650	5.720***
Tobin's Q	3.128	20.730***	1.123	4.750***	1.729	6.640***	0.853	3.440***
Leverage	-4.549	-9.410***	9.911	10.850***	9.798	10.450***	-11.482	-12.390***
ROA x 100	0.262	12.100***	-0.053	-2.410**	-0.056	-2.890***	0.230	8.990***
Lagged NWC/assets			3.633	3.970***	4.417	4.590***		
Lagged Cash/assets			6.342	4.950***	2.513	1.920*		
Net operating cash flow/assets			0.320	12.630***	-0.573	-22.720***		
Year fixed effects	Yes		Yes		Yes		Yes	
Industry fixed effects	Yes		Yes		Yes		Yes	
R-Square	0.407		0.158		0.221		0.149	
N Obs	8,797		8,238		8,238		8,797	
<i>Panel B: Firm years with book value of total assets in the lowest three quartiles</i>								
Dependent Variable	Model 1		Model 2		Model 3		Model 4	
	Net operating cash flow/assets		Net investing cash flow/assets		Net financing cash flow/assets		Free cash flow/assets	
	Est.	t Value	Est.	t Value	Est.	Est.	Est.	t Value
Intercept	-1.254	-1.210	-6.766	-1.950 *	-8.253	-2.260 **	-33.070	-5.510 ***
Diversification	0.294	2.000 **	-0.648	-3.200 ***	-1.069	-5.000 ***	1.263	5.490 ***
Firm size	1.391	19.400 ***	0.713	8.350 ***	0.471	5.030 ***	0.379	3.730 ***
Tobin's Q	-0.033	-0.390	2.050	16.640 ***	3.623	25.130 ***	-2.162	-16.260 ***
Leverage	-0.227	-0.490	6.828	9.940 ***	6.143	8.190 ***	-4.530	-6.320 ***
ROA x 100	0.587	73.640 ***	-0.011	-1.110	0.003	0.260	0.476	50.380 ***
Lagged NWC/assets			0.821	1.430	0.333	0.490		
Lagged Cash/assets			1.927	2.830 ***	-2.773	-3.880 ***		
Net operating cash flow/assets			0.250	18.750 ***	-0.545	-39.250***		
Year fixed effects	Yes		Yes		Yes		Yes	
Industry fixed effects	Yes		Yes		Yes		Yes	
R-Square	0.594		0.149		0.329		0.306	
N Obs	25,998		21,861		21,859		25,995	

This table reports regressions of the determinants of cash flows separately for large and small firms. Large firms are identified as those in the largest quartile of book value of total assets. Small firms are identified as those in the lowest three quartiles of book value of total assets. These models use OLS regression with year and industry fixed effects and standard errors are clustered at the firm level. All variables are defined in Table 1.

***, ** and *, indicate that estimates are significant at the 1%, 5%, and 10% level respectively.

Table 10 Diversification and cash flow components for large and small firms

<i>Panel A: Firm years with a positive value for R&D expenditure</i>								
	Model 1		Model 2		Model 3		Model 4	
Dependent Variable	Net operating cash flow/assets		Net investing cash flow/assets		Net financing cash flow/assets		Free cash flow/assets	
	Est.	t Value	Est.	t Value	Est.	Est.	Est.	t Value
Intercept	-6.297	-8.030***	-0.920	-0.370	3.886	1.530	23.273	21.250***
Diversification	-0.526	-2.400**	-0.775	-2.550**	-0.867	-2.680***	0.333	0.980
Firm size	0.154	1.000	1.821	9.090 ***	3.127	14.090***	-2.002	-9.280***
Tobin's Q	1.178	15.260***	0.231	2.610 ***	-0.250	-2.670***	0.870	8.950***
Leverage	0.564	38.840***	-0.024	-1.290	0.031	1.930*	0.441	26.530***
ROA x 100	-2.298	-2.780***	6.433	5.300 ***	7.570	5.740***	-5.565	-4.590***
Lagged NWC/assets			2.377	2.080**	2.435	2.110**		
Lagged Cash/assets			3.905	3.380 ***	-1.086	-0.950		
Net operating cash flow/assets			0.276	11.070 ***	-0.511	-21.460 ***		
Year fixed effects	Yes		Yes		Yes		Yes	
Industry fixed effects	Yes		Yes		Yes		Yes	
R-Square	0.579		0.124		0.272		0.277	
N Obs	9,496		8,261		8,261		9,495	
<i>Panel B: Firm years with a zero value for R&D expenditure</i>								
	Model 1		Model 2		Model 3		Model 4	
Dependent Variable	Net operating cash flow/assets		Net investing cash flow/assets		Net financing cash flow/assets		Free cash flow/assets	
	Est.	t Value	Est.	t Value	Est.	Est.	Est.	t Value
Intercept	3.420	4.700 ***	-4.269	-2.850 ***	-4.367	-2.670 ***	-20.069	-4.500 ***
Diversification	0.063	0.470	-0.672	-3.600 ***	-1.073	-5.530 ***	1.260	5.920 ***
Firm size	0.013	0.150	1.806	13.860 ***	3.145	20.180 ***	-1.811	-12.900 ***
Tobin's Q	0.837	17.410 ***	0.035	0.600	-0.215	-3.430 ***	0.670	9.900 ***
Leverage	0.593	65.010 ***	-0.013	-1.210	-0.015	-1.250	0.481	44.960 ***
ROA x 100	-0.064	-0.150	8.436	13.040 ***	7.722	10.980 ***	-5.831	-8.430 ***
Lagged NWC/assets			1.323	2.380 **	1.067	1.570		
Lagged Cash/assets			2.640	3.630 ***	-1.659	-2.120 **		
Net operating cash flow/assets			0.259	18.720 ***	-0.555	-37.180***		
Year fixed effects	Yes		Yes		Yes		Yes	
Industry fixed effects	Yes		Yes		Yes		Yes	
R-Square	0.583		0.151		0.332		0.301	
N Obs	25,313		21,851		21,849		25,311	

This table reports regressions of the determinants of cash flows separately for firm-years with research and development (R&D) expenditure and firm-years with zero R&D expenditure. We define firm years with missing R&D expenditure and zero R&D firm-years. These models use OLS regression with year and industry fixed effects and standard errors are clustered at the firm level. All variables are defined in Table 1.

***, ** and *, indicate that estimates are significant at the 1%, 5%, and 10% level respectively.